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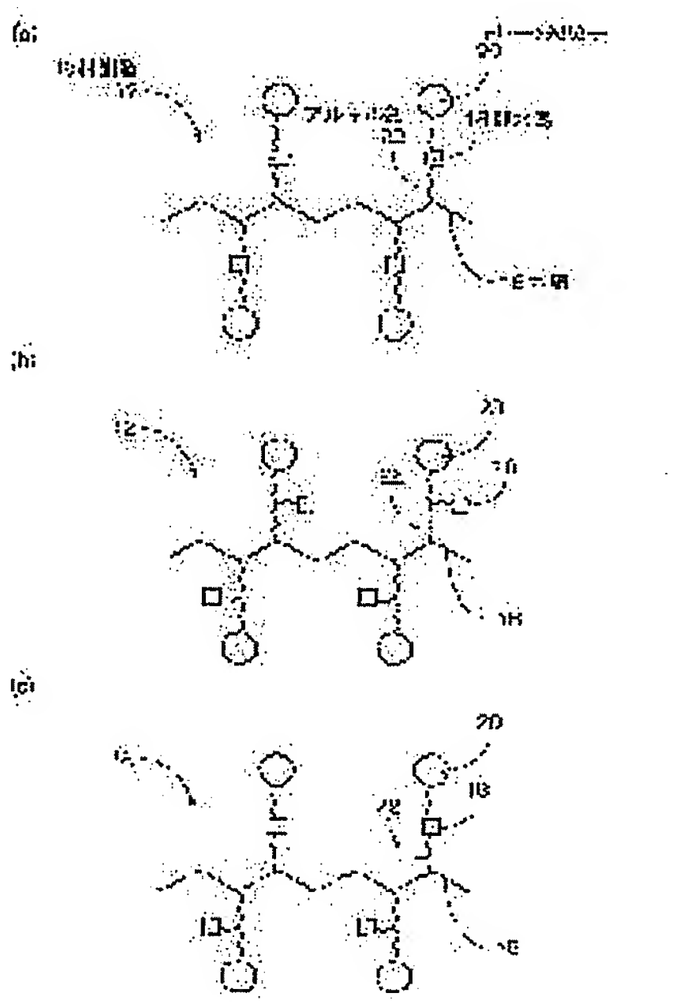
(54) ABRADING BLOCK AND POLISHING METHOD USING THE ABRADING BLOCK

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a technique wherein suitable polishing work by a CMP method is enabled, without using slurry.
SOLUTION: Since base material resin 12, constituting an abrasion block 10, is a chelate resin which is provided with chelate ligand 20 combined with a main chain 16 via an alkyl chain 22, the resin 12 is hardly affected by stereostructure barrier and easily captures fine metal particles and metal ions which are released in polishing solution. Further, a hydrophilic group 18 is installed in the resin 12, so that abundant water is applied to the periphery of the chelate ligand 20, and a superior chelate forming capability can be obtained. Since abrasive particles 14, whose mean particle diameter is at least 1nm and smaller than 1μm, are contained at a ratio of at least 5 wt.% and at most 60 wt.%, sufficient abrasive performance can be obtained conjointly with the abrasive performance given to the base material resin 12 itself. As a result, the abrasion block 10, wherein suitable polishing work by a CMP method is enabled without using slurry can be provided.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]
It is the polish object which is equipped with base material resin and many polish particles, is formed in disc-like, and is chiefly used for polish processing by the CMP method,
Said base material resin is a polish object with which it is the chelating resin equipped with the hydrophilic group and the chelate ligand combined with the principal chain through the alkyl chain, and mean particle diameter is characterized by including 1nm or more polish particle it is [particle] less than 1 micrometer at less than 60% of the weight of a rate 5% of the weight or more.
[Claim 2]
Said polish object is a polish object of claim 1 which is a thing containing an oxidizer or a reducing agent.
[Claim 3]
Said polish object is a polish object of claims 1 or 2 which are what contains the photocatalyst which has the oxidation or a reduction operation at less than 60% of the weight of a rate 1% of the weight or more.
[Claim 4]
It is the polish processing approach of the format which carries out relative rotation, pushing the ground body against the disc-like polish object stuck on the surface plate, and supplying polish liquid among them,
The polish processing approach characterized by collecting and filtering the polish liquid which was supplied between said polish object and the ground body, and was used for polish processing, and supplying as polish liquid again, destroying said base material resin always mechanically or chemically using which polish object of claims 1-3 as said polish object.
[Claim 5]
The polish processing approach of claim 4 which is that to which wavelength irradiates 200nm or more light it is [light] less than 600nm at this polish object, using the polish object of claim 3 as said polish object.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to the polish object used suitable for polish processing by the CMP method of for example, a semi-conductor wafer etc., and the polish processing approach using the polish object.
[0002]
[Description of the Prior Art]
Generally, in manufacture of a VLSI, much chips are formed in a semi-conductor wafer, and the process of cutting to each chip size by the final process is taken. Recently, since a degree of integration improves by leaps and bounds with improvement in the manufacturing technology of a VLSI and multilayering of wiring is progressing, in the process which forms each class, flattening (global planarization) of the whole semi-conductor wafer is required. as one of the technique which realizes flattening of such a whole semi-conductor wafer -- CMP (Chemical Mechanical Polishing: chemical mechanical polish) -- the polish processing approach of law is mentioned. A wafer is pushed against scouring pads, such as a nonwoven fabric stuck on the surface plate, or a foaming pad, forcible rotation is carried out, and this CMP method grinds by passing the slurry (thick suspension which fine powder is distributing in liquids, such as aqueous acids) which contained the detailed polish particle (loose grain) there. According to this CMP method, high polish processing of precision is performed by the synergistic effect of the chemical polish by the liquid component, and the mechanical polish by the loose grain.
[0003]
[Problem(s) to be Solved by the Invention]
However, it was that to which polish processing is performed by such conventional CMP method, supplying a slurry to a scouring pad regularly, it goes and takes, and consumption of a slurry increases. Since a used slurry was asked for the processing as industrial waste, in addition to the costs which cannot be disregarded to abandonment starting, it was not desirable from a viewpoint of environmental protection. Moreover, that cost starts most in polish processing by the CMP method was a polish particle contained in a slurry, and since not all the polish particles contained in a slurry further necessarily participated in polish processing and many polish particles were discarded vainly, it had the fault of being noneconomic. For the reason, development of the technique of realizing polish processing by the CMP method do not use a slurry has come to be called for.
[0004]
this invention person is using the polish object which used as base material resin the chelating resin which contains a polish particle at a predetermined rate, while continuing research wholeheartedly the technique of realizing polish processing by the CMP method not using a slurry being developed, and came to think whether suitable polish processing can be performed. It is expected that base material resin equipped with the chelate ligand itself will present the polish engine performance by catching the detailed metal particles thru/or the detailed metal ion which separates in polish liquid on the occasion of polish processing by the CMP method by the chelate ligand.
[0005]
Like the polish object indicated by JP,11-188647,A, although the polish object which fixed

abrasives by chelating resin on the flexible base material is proposed, until now this polish object is not a thing aiming at improvement in the polish engine performance -- in addition, although improvement in the polish engine performance is also expectable if polish processing is performed replacing a polished surface continuously using a band-like polish object with delivery since the chelate formation function of chelating resin is saturated comparatively for a short time When used in the condition of having been stuck on the surface plate as mentioned above, the function which catches a metal ion immediately will fall. Moreover, it is easy to generate the blinding of the glazing of a polish particle and eye 0 **, or a polish object, and the fault of being as the shape of front planarity of the ground body getting worse **** [, and] arises. [that the polish engine performance falls in such a case] Furthermore, since the above-mentioned band-like polish object after use is asked for the processing as industrial waste, in addition to abandonment cost increasing, there is a problem also from a viewpoint of environmental protection.

[0006]

Moreover, in carrying out predetermined time continuation and performing polish processing like the polish approach using the abrasive cloth for metals and it which were indicated by JP,2001-138213,A since what catches a metal ion is proposed and the chelate formation function of chelating resin is comparatively saturated for a short time also about this abrasive cloth for metals so that the polish engine performance may be given to the chelating resin itself, polish efficiency falls immediately and it does not bear practical use. Moreover, since in addition to being hard to catch the detailed metal particles thru/or the detailed metal ion which separates in polish liquid that it is easy to be influenced of a spacial configuration failure since the chelating resin which the chelate ligand coupled directly with the principal chain is used water is not brought to the perimeter of a chelate ligand when a principal chain is hydrophobicity, the chelate organization potency force is comparatively weak, and cannot give sufficient polish engine performance for the chelating resin itself. From such a reason, the slurry had to be used together as a result. That is, although the various polish objects using chelating resin as base material resin of said polish object are proposed, the present condition is that the technique in which ** also realizes suitable polish processing by the CMP method not using a slurry is not yet developed.

[0007]

Succeeding in this invention against the background of the above situation, the place made into the purpose is not using a slurry to offer the technique in which ** can also perform suitable polish processing by the CMP method.

[0008]

[The 1st means for solving a technical problem]

In order to solve this technical problem, the place made into the summary of **** 1 invention It is the polish object which is equipped with base material resin and many polish particles, is formed in disc-like, and is chiefly used for polish processing by the CMP method. Said base material resin A hydrophilic group, It is the chelating resin equipped with the chelate ligand combined with the principal chain through the alkyl chain, and mean particle diameter is characterized by including 1nm or more polish particle it is [particle] less than 1 micrometer at less than 60% of the weight of a rate 5% of the weight or more.

[0009]

[The 1st effect of the invention]

In order to have a hydrophilic group in addition to being easy to catch the detailed metal particles thru/or the detailed metal ion which separates in polish liquid that it cannot be easily influenced of a spacial configuration failure since the base material resin which constitutes said polish object if it does in this way is chelating resin equipped with the chelate ligand combined with the principal chain through the alkyl chain, the chelate organization-potency force in_which of it excelled by bringing abundant water to the perimeter of this chelate ligand is acquired. Moreover, since mean particle diameter contains 1nm or more polish particle which is less than 1 micrometer at less than 60% of the weight of a rate 5% of the weight or more, sufficient polish capacity is conjointly acquired with the polish engine performance given to said base material resin itself. That is, the polish object with which ** can also perform suitable polish processing by the CMP method not using a slurry can be offered. In addition, when said polish particle is 5 or less % of the weight, sufficient polish capacity is not acquired, but in being 60 % of the weight

or more, a scratch blemish becomes easy to go into the ground body.
[0010]
[Other modes of the 1st invention]
Here, said polish object contains an oxidizer or a reducing agent suitably. If it does in this way, when the oxidizer or reducing agent contained in said polish object itself begins to melt into the polish liquid supplied on the occasion of polish processing, there is an advantage of contributing to the chemical polish by the liquid component in the CMP method.
[0011]
Moreover, said polish object contains suitably the photocatalyst which has the oxidation or a reduction operation at less than 60% of the weight of a rate 1% of the weight or more. thus, if it carries out, the chemical polish engine performance by the liquid component improves by irradiating light in the CMP method at said polish object, and even if it uses water as polish liquid, there is an advantage that sufficient polish engine performance is obtained, by acting on the polish liquid with which it comes out comparatively and less than 60% of the weight of the contained photocatalyst is supplied to said polish object itself on the occasion of polish processing 1% of the weight or more. In addition, when said photocatalyst is 1 or less % of the weight, it is hard to produce the oxidation or a reduction operation, and in being 60 % of the weight or more, a scratch blemish becomes easy to go into the ground body.
[0012]
[The 2nd means for solving a technical problem]
In order to solve said technical problem, moreover, the place made into the summary of **** 2 invention It is the polish processing approach of the format which carries out relative rotation, pushing the ground body against the disc-like polish object stuck on the surface plate, and supplying polish liquid among them. It is characterized by collecting and filtering the polish liquid which was supplied between said polish object and the ground body, and was used for polish processing, and supplying as polish liquid again, destroying said base material resin always mechanically or chemically using the polish object of said 1st invention as said polish object.
[0013]
[The 2nd effect of the invention]
If it does in this way, since it will be what performs polish processing, destroying said base material resin always mechanically or chemically in addition to the polish capacity in which said base material resin itself was excellent on the occasion of polish processing being shown since the polish object of said 1st invention is used as said polish object, a continuously new polished surface expresses on said polish object, and the chelate organization-potency force of the base material resin is maintained, without falling. Moreover, since it is what collects and filters the polish liquid which was supplied between said polish object and the ground body, and was used for polish processing, and is again supplied as polish liquid, in addition to it being few and ending, abandonment cost is desirable also from a viewpoint of environmental protection. That is, the suitable polish processing approach using said polish object with which ** can also perform suitable polish processing by the CMP method not using a slurry can be offered.
[0014]
[Other modes of the 2nd invention]
Here, suitably, said polish object contains the photocatalyst which has the oxidation or a reduction operation at less than 60% of the weight of a rate 1% of the weight or more, and wavelength irradiates 200nm or more light it is [light] less than 600nm at the polish object. thus, if it carries out, it acts on the polish liquid with which it comes out comparatively and less than 60% of the weight of the contained photocatalyst is supplied on the occasion of polish processing by the CMP method 1% of the weight or more to said polish object itself, and the chemical polish engine performance by the liquid component improves on the polish object because wavelength irradiates 200nm or more the light it is [light] less than 600nm, and even if it uses water as polish liquid, the advantage that sufficient polish engine performance is obtained is.
[0015]
[Example]
Hereafter, the suitable example of this invention is explained to a detail based on a drawing.
[0016]
Drawing 1 is the perspective view showing the polish object 10 which is one example of this

invention. as shown in this drawing, this polish object 10 is equipped with base material resin 12 and many polish particles 14, and that dimension sticks it on the turn table 20 of the polish processing equipment 18 shown in drawing 3 so that it may be formed in disc-like [which is about 5mm of 450mm phixt] and may mention later -- having -- chiefly -- CMP (Chemical Mechanical Polishing: chemical mechanical polish) -- it is used for polish processing by law.
[0017]
The chelating resin obtained by mixing and heating the bisphenol system epoxy base resin of 6 weight sections, the alicyclic amine system curing agent of 2 weight sections, and the straight chain 2 organic-functions epoxy of 2 weight sections and imino 2 acetic acid as the above-mentioned base material resin 12, for example is used suitably. Drawing 2 is drawing showing the configuration of the part in this chelating resin typically, and (a of the example of a configuration in which the hydrophilic group was prepared in the halfway of an alkyl chain, and (b)) is [the example of a configuration for which a hydrophilic group accomplishes the side chain of an alkyl chain, and (c)] the examples of a configuration with which the configuration with which the hydrophilic group was prepared in the halfway of an alkyl chain, and the configuration which accomplishes the side chain of an alkyl chain were combined. As shown in this drawing, the above-mentioned chelating resin is a hydrophilic group (a water molecule and weak coupling are built by the electrostatic interaction, hydrogen bond, etc.). Functional groups, such as hydroxyl in which compatibility is shown to water, a carboxyl group, an amino group, a carbonyl group, and a sulfonic group, ester and an amide, the ether, and the ketone structure 18, It has the chelate ligand (functional group which can form a metal ion etc. and a chelate bond) 20 combined with the principal chain 16 through the alkyl chain (chain-like atomic group expressed with general formula CnH2n) 22. By catching metal particles thru/or a metal ion by the chelate ligand 20, it is thought that the polish engine performance is given to said base material resin 12 itself. Here, the above-mentioned base material resin 12 is a thing which has the oxidation or a reduction operation still more suitably including an oxidizer or reducing agents, such as a hydrogen peroxide, and which contains photocatalysts, such as titanium oxide, at less than 60% of the weight of a rate 1% of the weight or more, for example suitably. Moreover, mean diameters are the spherical silica 1nm or more which is less than 1 micrometer, an alumina, a zirconia, Seria, a manganese dioxide, etc., and the above-mentioned polish particle 14 is contained in the above-mentioned polish object 10 at less than 60% of the weight of a rate 5% of the weight or more.
[0018]
Said polish object 10 is manufactured as follows, for example. That is, the chelating resin which constitutes the above-mentioned base material resin 12 is formed by mixing and heating the above-mentioned predetermined resin ingredient which is a raw material of chelating resin first. Next, before the chelating resin formed by making it such hardens, the above-mentioned oxidizer or a reducing agent, a photocatalyst, and a polish particle are supplied to the chelating resin, and are mixed and agitated. Then, the polish object 10 of this example is manufactured by carrying out casting of the mixed raw material to a predetermined mold, and stiffening it in ordinary temperature.
[0019]
Drawing 3 is drawing showing the rough configuration of the polish processing equipment 24 by the CMP method said polish object 10 is used, and the top view which looked at (a) from [of a turn table 26] the axial center, and (b) are front views. As shown in this drawing, with this polish processing equipment 24, the turn table 26 is formed in the circumference of that axial center in the condition of having been supported pivotable, and the rotation drive of that turn table 26 is carried out by the surface plate drive motor which is not illustrated to one hand of cut shown in drawing by the arrow head. The polish object 10 of this example is stuck on the field where it is pushed, the top face, i.e., the ground body, of this turn table 26. On the other hand, near the above-mentioned turn table 26, where the work-piece attachment component 28 for holding the ground body is supported movable in pivotable and its direction of an axial center at the circumference of the axial center, it is arranged, and the rotation drive of the work-piece attachment component 28 is carried out to one hand of cut shown in drawing by the arrow head with the work-piece drive motor which is not illustrated. Adsorption maintenance of the wafer 32 which is the ground body is carried out through an adsorption layer 30 in the inferior surface of tongue 10 of this work-piece attachment component 28, i.e., the above-mentioned polish object, and the field which counters. Moreover, it is contacted so that the dashboard 34 which consists

of synthetic resin equipped with predetermined elasticity etc. may cross in the direction of a path through the core of the polish object 10, and on both sides of the dashboard 34, the 2nd nozzle 38 is arranged for the 1st nozzle 36 in the opposite side at the work-piece attachment component 28 side, respectively. Moreover, the adjustment tool attachment component 40 arranged movable in pivotable, its direction of an axial center, and the direction of a path of said turn table 26, and the inferior surface of tongue 10 of the adjustment tool attachment component 40, i.e., said polish object, and the polish condition ready tool 42 attached in the field which counters are formed in the circumference of an axial center parallel to the axial center of said turn table 26.

[0020]

Drawing 4 is process drawing showing the process which performs polish processing by the CMP method using said polish object 10. As shown in drawing 3 and drawing 4 , polish processing by the CMP method is faced. The polish object 10 first stuck on the above-mentioned turn table 26 and it in the polish liquid supply process S1, Where a rotation drive is carried out at the circumference of each axial center by the above-mentioned surface plate drive motor and the work-piece drive motor, the wafer 32 by which adsorption maintenance was carried out at the work-piece attachment component 28 and it From the 1st nozzle 36 of the above, and the 2nd nozzle 38, the wafer 32 by which adsorption maintenance was carried out is pushed against the polish object 10 at the work-piece attachment component 28, polish liquid, such as an acetic-acid water solution, being supplied on the front face of the above-mentioned polish object 10, for example. By doing so, the field which counters, the polished surface 10-ed, i.e., above-mentioned polish object, of the above-mentioned wafer 32, is evenly ground by chemical scouring with this polish liquid, and mechanical scouring by the base material resin 12 with which the polish particle 14 and metal ion by which self-supply was carried out with the above-mentioned polish object 10 were caught, and the polish engine performance was given.

[0021]

It gets mixed up with the above-mentioned polish liquid supply process S1, and said polish object 10 is destroyed a minute amount every in the polish object minute amount destructive process S2. The polish condition ready tool 42 attached in said adjustment tool attachment component 40 and it this minute amount destruction It is pushed against said polish object 10 where a rotation drive is carried out by the adjustment tool drive motor which is not illustrated. If needed, with the polish liquid supplied in the direction of a path of said turn table 26 from said 2nd nozzle 38 mechanically by carrying out both-way migration, it destroys chemically and is always continuously carried out on the occasion of polish processing. As shown in drawing 5 , said polish processing equipment 24 is equipped with the pH regulator 44 which adjusts pH of the polish liquid supplied from said 1st nozzle 36 and 2nd nozzle 38, respectively here. From said 1st nozzle 36, the with a pH of about four polish liquid suitable for polish processing of the wafer 32 which is the ground body From said 2nd nozzle 38, the with a pH of about one polish liquid suitable for destroying chemically the base material resin 12 of said polish object 10 a minute amount every is supplied, respectively. It is maintained without a continuously new polished surface's expressing and the chelate organization potency force of the base material resin 12 declining according to it, since the base material resin 12 of said polish object 10 is destroyed a minute amount every by this polish object minute amount destructive process S2.

[0022]

Moreover, it gets mixed up with said polish liquid supply process S1 and the polish object minute amount destructive process S2, and in the optical exposure process S3, as shown in drawing 3 (b), the light whose wavelength is 200nm or more less than 600nm is irradiated by said polish object 10. Since it is the thing in which this polish object 10 has the oxidation or a reduction operation as mentioned above and which contains photocatalysts, such as titanium oxide, for example, the light irradiated such acts on the polish liquid which said photocatalyst is made to produce the oxidation or a reduction operation, and is supplied from said 1st nozzle 30, and its chemical polish engine performance by the liquid component in the CMP method improves.

[0023]

Moreover, it gets mixed up with said polish liquid supply process S1, the polish object minute amount destructive process S2, and the optical exposure process S3, and the polish liquid which was supplied between the wafers 32 which are said polish object 10 and the ground body, and was used for polish processing is collected in polish liquid recovery process S4. Here, as shown

in drawing 5 , said polish processing equipment 24 is equipped with the filter 46 of 0.1 micrometer phi extent of apertures for filtering the collected polish liquid, and the polish liquid collected in the above-mentioned polish liquid recovery process S4 is sent to the above-mentioned pH regulator 44 in the polish liquid filtration process S5, after being filtered with this filter 46 and removing discard, such as polish waste. And by pH's being adjusted by the pH regulator 44 and supplied from said 1st nozzle 36 and 2nd nozzle 38, it is again used for polish processing.

[0024]

Next, in order to verify the effectiveness of this invention, the polish trial which this invention person performed is explained. In this polish trial The bisphenol system epoxy base resin of 6 weight sections, The chelating resin obtained by mixing and heating the alicyclic amine system curing agent of 2 weight sections, and the straight chain 2 organic-functions epoxy of 2 weight sections and imino 2 acetic acid at 45% of the weight of a rate The example sample 1 of this invention which contains the spherical silica whose mean particle diameter is 0.3 micrometers at 55% of the weight of a rate, The chelating resin obtained by mixing and heating the bisphenol system epoxy base resin of 6 weight sections, the alicyclic amine system curing agent of 2 weight sections, and the straight chain 2 organic-functions epoxy of 2 weight sections and imino 2 acetic acid at 45% of the weight of a rate The example sample 2 of this invention which contains the titanium oxide powder whose mean particle diameter is 0.3 micrometers at 40% of the weight of a rate about the spherical silica whose mean particle diameter is 0.3 micrometers at 15% of the weight of a rate, The example sample of a comparison which is the urethane foam pad used for the conventional CMP method using a slurry was prepared, and polish processing was performed using each sample. Those samples were equipped with the about [outer-diameter 450mmphix thickness t5mm] dimension. The test condition and test result of the polish trial are shown below.

[0025]

[Test condition]

Lubricant: The 10 % of the weight water solution of hydrogen peroxides

Slurry: 12 % of the weight content of 80nm silicas Mixed liquor of the 10 % of the weight water solution of hydrogen peroxides, and pH triacetic acid water solution

Work piece 1: Copper plate (1.0mm of 150mm phixt)

The silicon wafer which filled the slot of a 2:0.5 micrometer work piece by copper plating (0.6mm of 150mm phixt)

The number of work-piece rotations: 60rpm [1s-1]

Polish rotating speed: 60rpm [1s-1]

Processing planar pressure: 300 gf/cm2 [29.4kPa]

Polish volume: 500 ml/min [8.3cm3/s]

Others: Polish processing was performed, irradiating light with a wavelength of 365nm at the example sample 2 of a comparison.

[試験結果]

研磨液	研磨体	研磨能率 (ワーク1)	ディッシング量 (ワーク2)
水	実施例試料1	150nm/min[2.5nm/s]	60nm
ルブリカント	実施例試料1	280nm/min[4.7nm/s]	80nm
水	実施例試料2	320nm/min[5.3nm/s]	90nm
スラリ	比較例試料	290nm/min[4.8nm/s]	120nm

[0026]

In polish processing from this test result, are the thing using the example sample 1 as a polish object, and polish efficiency was inferior a little, using water as polish liquid, and also using the example samples 1 or 2 of this invention, it was checked comparable as polish processing by the conventional CMP method using the urethane foam pad as a polish object or that the more excellent polish efficiency is shown, using a slurry as polish liquid. moreover, the front face which

had less all of polish processing using the example samples 1 or 2 of this invention than polish processing by the conventional CMP method, they ended, and was more excellent in them about the amount of dishing which shows the amount of depressions of the copper plating buried in the 0.5-micrometer slot formed in the silicon wafer of a work piece 2 -- it was checked that description is acquired. Furthermore, in what performed polish processing, irradiating light with a wavelength of 365nm using the example sample 2 as a polish object, even if it used water as polish liquid, it was checked that the result that polish efficiency and the amount of dishing excelled polish processing by the conventional CMP method is obtained. That is, according to the polish object of this invention, and the polish processing approach using the polish object, it was verified that ** can also perform suitable polish processing by the CMP method not using a slurry.

[0027]

Thus, in order to have a hydrophilic group 18 in addition to being easy to catch the detailed metal particles thru/or the detailed metal ion which separates in polish liquid that it cannot be easily influenced of a spacial-configuration failure since the base material resin 12 which constitutes said polish object 10 according to this example is chelating resin equipped with the chelate ligand 20 combined with the principal chain 16 through the alkyl chain 22, the chelate organization-potency force in_which of it excelled by bringing abundant water to the perimeter of this chelate ligand 20 is acquired. Moreover, since mean particle diameter contains the 1nm or more polish particle 14 which is less than 1 micrometer at less than 60% of the weight of a rate 5% of the weight or more, sufficient polish capacity is conjointly acquired with the polish engine performance given to said base material resin 12 itself. That is, the polish object 10 with which ** can also perform suitable polish processing by the CMP method not using a slurry can be offered.

[0028]

Moreover, since said polish object 10 is a thing containing an oxidizer or a reducing agent, when the oxidizer or reducing agent contained in said polish object 10 itself begins to melt into the polish liquid supplied on the occasion of polish processing, it has the advantage of contributing to the chemical polish by the liquid component in the CMP method.

[0029]

Moreover, since said polish object 10 is what contains the photocatalyst which has the oxidation or a reduction operation at less than 60% of the weight of a rate 1% of the weight or more, By acting on the polish liquid with which the photocatalyst contained at less than 60% of the weight of a rate 1% of the weight or more is supplied to said polish object 10 itself on the occasion of polish processing The chemical polish engine performance by the liquid component improves by irradiating light in the CMP method at said polish object 10, and even if it uses water as polish liquid, there is an advantage that sufficient polish engine performance is obtained.

[0030]

Moreover, it adds to the polish capacity in which said base material resin 12 itself was excellent on the occasion of polish processing being shown since said polish object 10 is used according to this example. Since it is what performs polish processing, destroying said base material resin 12 always mechanically or chemically in the polish object minute amount destructive process S2, it is maintained without a continuously new polished surface's expressing on said polish object 10, and the chelate organization potency force of the base material resin 12 declining. Moreover, in polish liquid recovery process S4, collect the polish liquid which was supplied in the polish liquid supply process S1 between the wafers 32 which are said polish object 10 and the ground body, and was used for polish processing, and it is filtered in the continuing polish liquid filtration process S5. Since it is what is again supplied as polish liquid in the polish liquid supply process S1, in addition to trash being reducible to 1 / 100 - 1/10 compared with polish processing by the CMP method using the conventional slurry, and there being little abandonment cost and ending, it is desirable also from a viewpoint of environmental protection. That is, the suitable polish processing approach using said polish object 10 with which ** can also perform suitable polish processing by the CMP method not using a slurry can be offered.

[0031]

Moreover, said polish object 10 is what contains the photocatalyst which has the oxidation or a reduction operation at less than 60% of the weight of a rate 1% of the weight or more. Since it is that to which wavelength irradiates 200nm or more light it is [light] less than 600nm in the

optical exposure process S3 at the polish object, It acts on the polish liquid with which the photocatalyst contained at less than 60% of the weight of a rate 1% of the weight or more is supplied to said polish object 10 itself on the occasion of polish processing by the CMP method. Even if the chemical polish engine performance by the liquid component improves on the polish object 10 because wavelength irradiates 200nm or more light it is [light] less than 600nm, and it uses water for it as polish liquid, there is an advantage that sufficient polish engine performance is obtained.

[0032]

as mentioned above, the thing by which this invention is limited to this although the suitable example of this invention was explained to the detail based on the drawing -- it is not -- still more nearly another voice -- it also sets like and carries out.

[0033]

For example, in the above-mentioned example, although said polish object 10 was used for polish processing of a semi-conductor wafer, this invention is not limited to this and is widely used for polish processing according [for example,] to the CMP method of various abrasives-ed, such as surface superfinishing processing of a metallic material.

[0034]

Moreover, although epoxy system resin was used as a principal chain of said base material resin 12 in the above-mentioned example, you may be the chelating resin using acrylic resin etc. as a principal chain, for example. It does not pass over this in the suitable example of this invention to the last, for example, various chelating resin is suitably chosen according to the description of the ground body etc., and said base material resin 12 is used, although it was the chelating resin obtained by mixing and heating bisphenol system epoxy base resin, an alicyclic amine system curing agent, and straight chain 2 organic-functions epoxy and imino 2 acetic acid.

[0035]

Moreover, in the above-mentioned example, although said polish object 10 contained the hydrogen peroxide as an oxidizer, this may be iron nitrate or a potassium iodate. That is, the class will not be asked if it is the oxidizer or reducing agent which begins to melt into polish liquid on the occasion of polish processing by the CMP method, and is contributed to the chemical polish.

[0036]

Moreover, in the above-mentioned example, although said polish object 10 contained titanium oxide powder as a photocatalyst, this may be for example, a silicon semi-conductor or a zirconia. That is, it has the oxidation or a reduction operation, and the class will not be asked if it contributes to chemical polish of polish liquid on the occasion of polish processing by the CMP method.

[0037]

Moreover, although especially the above-mentioned example does not explain, even if the principal chain 16 of said base material resin 12 is equipped with various side chains, such as other alkyl chains equipped not only with said alkyl chain 22 but the hydrophilic group, naturally it is not cared about.

[0038]

In addition, although instantiation is not carried out one by one, within limits which do not deviate from the meaning, various modification is added and this invention is carried out.

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing the polish object which is one example of this invention.

[Drawing 2] It is drawing showing typically the configuration of the part in the base material resin of the polish object of drawing 1 , and (a of the example of a configuration in which the hydrophilic group was prepared in the halfway of an alkyl chain, and (b)) is [the example of a configuration for which a hydrophilic group accomplishes the side chain of an alkyl chain, and (c) the examples of a configuration with which the configuration with which the hydrophilic group was prepared in the halfway of an alkyl chain, and the configuration which accomplishes the side chain of an alkyl chain were combined.

[Drawing 3] It is drawing showing the rough configuration of the polish processing equipment by the CMP method the polish object of drawing 1 is used, and the top view which looked at (a) from [of a turn table] the axial center, and (b) are front views.

[Drawing 4] It is process drawing showing the process which performs polish processing by the CMP method using the polish object of drawing 1 .
[Drawing 5] It is drawing explaining circulation of the polish liquid in polish processing by the CMP method using the polish processing equipment of drawing 3 .
[Description of Notations]
10: Polish object
12: Base material resin
14: Polish particle
16: Principal chain
18: Hydrophilic group
20: Chelate ligand
22: Alkyl chain
26: Turn table
32: Wafer (ground body)

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
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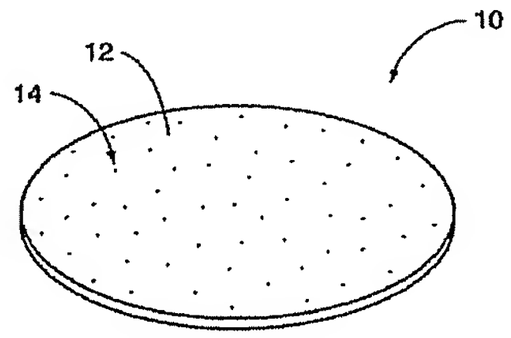
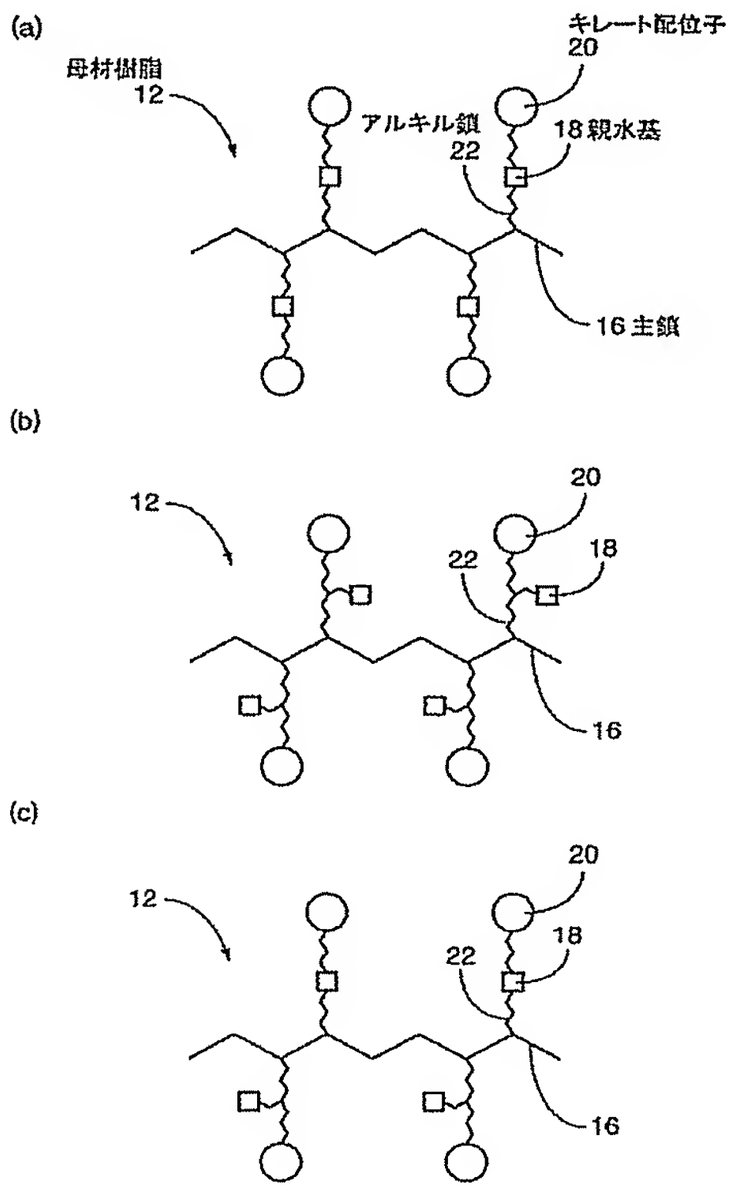
DRAWINGS

[Drawing 1]

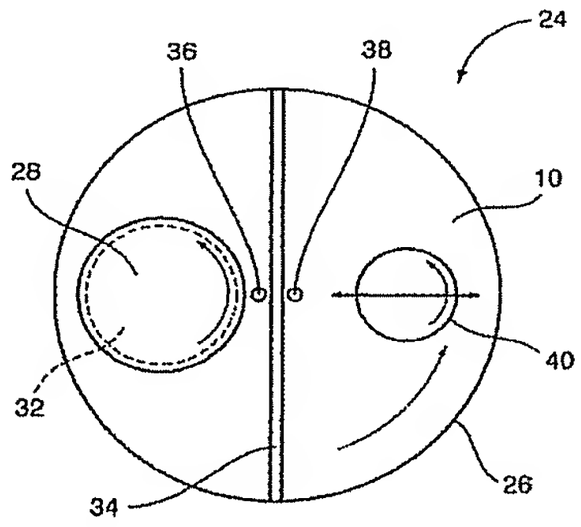


[Drawing 2]

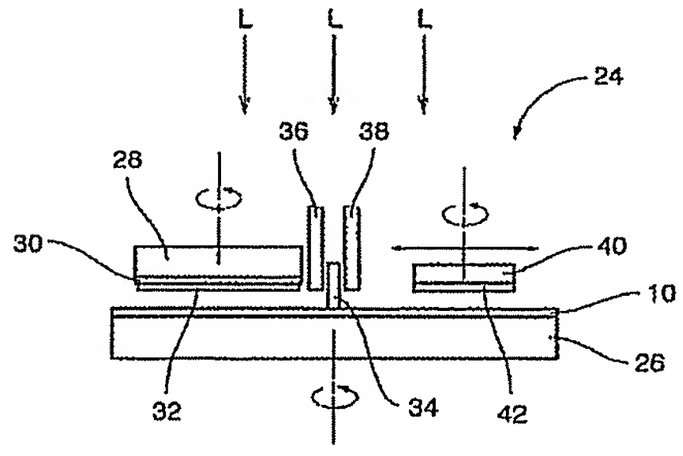


[Drawing 3]

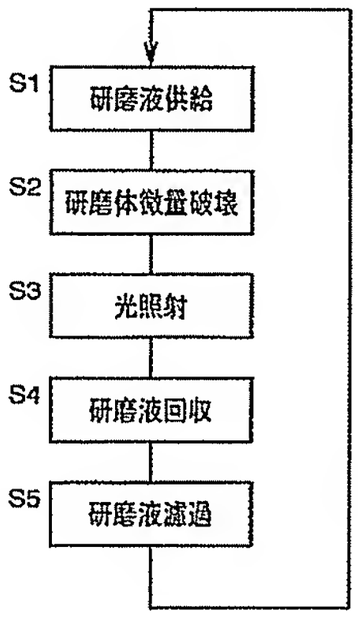
(a)



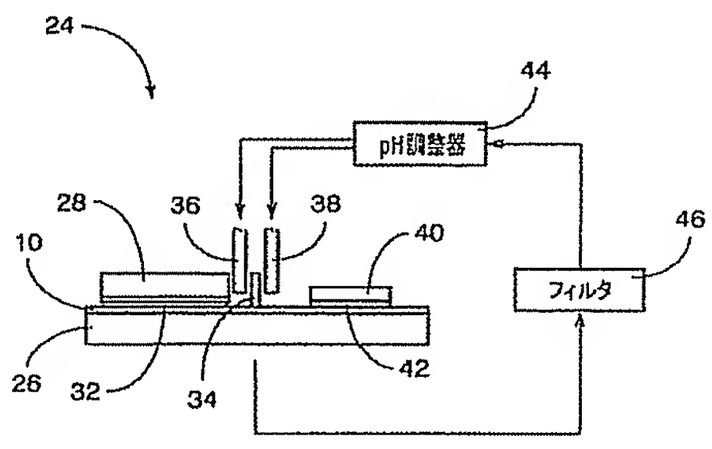
(b)



[Drawing 4]



[Drawing 5]



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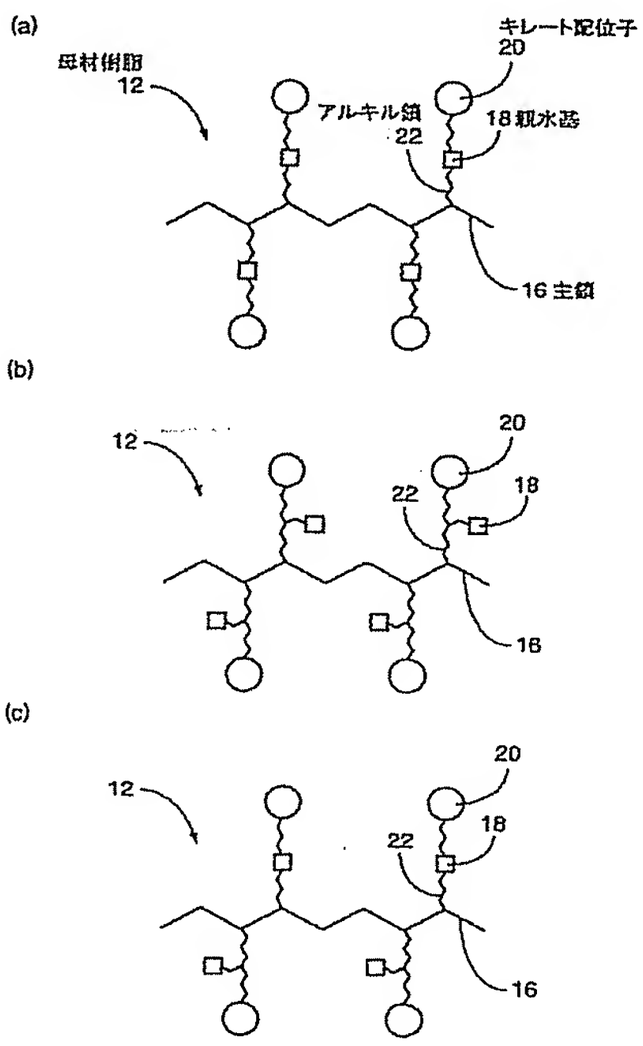
Fターム(参考) 3C063 AA02 AB05 BB01 BB03 BC03 BD01 EE10 EE26

(54)【発明の名称】研磨体およびその研磨体を用いた研磨加工方法

(57)【要約】
【課題】スラリを用いずともＣＭＰ法による好適な研磨加工をおこない得る技術を提供する。
【解決手段】研磨体１０を構成する母材樹脂１２はアルキル鎖２２を介して主鎖１６に結合したキレート配位子２０を備えたキレート樹脂である為、立体構造障害の影響を受け難く研磨液中に遊離する微細な金属粒子乃至金属イオンを捕捉し易いことに加え、親水基１８を備えたものである為、かかるキレート配位子２０の周囲に潤沢な水がもたらされることにより優れたキレート形成能力が得られる。また、平均粒径が１ｎｍ以上１μｍ未満である研磨粒子１４を５重量％以上６０重量％未満の割合で含んでいる為、上記母材樹脂１２そのものに付与される研磨性能と相俟って十分な研磨能力が得られる。すなわち、スラリを用いずともＣＭＰ法による好適な研磨加工をおこない得る研磨体１０を提供することができる。
【選択図】 図２



【特許請求の範囲】
【請求項１】
母材樹脂および多数の研磨粒子を備えて円板状に形成され、専らＣＭＰ法による研磨加工に用いられる研磨体であって、
前記母材樹脂は親水基と、アルキル鎖を介して主鎖に結合したキレート配位子とを備えたキレート樹脂であり、平均粒径が１ｎｍ以上１μｍ未満である研磨粒子を５重量％以上６０重量％未満の割合で含んでいることを特徴とする研磨体。
【請求項２】
前記研磨体は酸化剤または還元剤を含むものである請求項１の研磨体。
【請求項３】
前記研磨体は酸化作用あるいは還元作用を有する光触媒を１重量％以上６０重量％未満の割合で含むものである請求項１または２の研磨体。
【請求項４】
定盤上に貼られた円板状の研磨体に被研磨体を押しつけて、それらの間に研磨液を供給しつつ相対回転させる形式の研磨加工方法であって、
前記研磨体として請求項１から３の何れかの研磨体を用い、常時機械的にあるいは化学的に前記母材樹脂を破壊しつつ、前記研磨体と被研磨体との間に供給されて研磨加工に用いられた研磨液を回収し且つ濾過して再び研磨液として供給することを特徴とする研磨加工方法。
【請求項５】
前記研磨体として請求項３の研磨体を用い、該研磨体に波長が２００ｎｍ以上６００ｎｍ未満である光を照射するものである請求項４の研磨加工方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、たとえば半導体ウェハのＣＭＰ法による研磨加工などに好適に用いられる研磨体およびその研磨体を用いた研磨加工方法に関する。
【０００２】
【従来の技術】
一般に、超ＬＳＩの製造では半導体ウェハに多数のチップを形成し、最終工程で各チップサイズに切断するという製法が採られている。最近では超ＬＳＩの製造技術の向上に伴い集積度が飛躍的に向上し、配線の多層化が進んでいる為、各層を形成する工程においては、半導体ウェハ全体の平坦化（グローバルプラナリゼーション）が要求される。そのような半導体ウェハ全体の平坦化を実現する手法のひとつとして、ＣＭＰ（Ｃｈｅｍｉｃａｌ　Ｍｅｃｈａｎｉｃａｌ　Ｐｏｌｉｓｈｉｎｇ：化学的機械的研磨）法という研磨加工方法が挙げられる。このＣＭＰ法とは、定盤上に貼られた不織布あるいは発泡パッドなどの研磨パッドにウェハを押しつけて強制回転させ、そこに微細な研磨粒子（遊離砥粒）を含有したスラリ（細かい粉末がたとえば酸性水溶液などの液体中に分散している濃厚な懸濁液）を流して研磨をおこなうものである。かかるＣＭＰ法によれば、液体成分による化学的研磨と、遊離砥粒による機械的研磨との相乗効果によって精度の高い研磨加工がおこなわれる。
【０００３】
【発明が解決しようとする課題】
しかし、そのような従来のＣＭＰ法では、定常的にスラリを研磨パッドに供給しつつ研磨加工をおこなうものであり、いきおいスラリの消費がかさむものであった。使用済みのスラリには産業廃棄物としての処理が求められる為、廃棄に無視できない費用がかかることに加え、環境保護の観点からも好ましくなかった。また、ＣＭＰ法による研磨加工において最もコストがかかるのは、スラリに含まれる研磨粒子であり、さらには、必ずしもスラリに含まれる研磨粒子のすべてが研磨加工に関与するわけではなく、多数の研磨粒子が無駄に廃棄される為、非経済的であるという不具合があった。その為、スラリを用いないＣ

ＭＰ法による研磨加工を実現する技術の開発が求められるようになってきた。

【０００４】

本発明者は、スラリを用いないＣＭＰ法による研磨加工を実現する技術を開発すべく鋭意研究を継続する中で、所定の割合で研磨粒子を含むキレート樹脂を母材樹脂とした研磨体を用いることで、好適な研磨加工をおこない得るのではないかと考えるに至った。ＣＭＰ法による研磨加工に際して研磨液中に遊離する微細な金属粒子乃至金属イオンをキレート配位子により捕捉することで、そのキレート配位子を備えた母材樹脂そのものが研磨性能を呈することが期待されるのである。

【０００５】

これまでに、特開平１１－１８８６４７号公報に記載された研磨体のように、研磨材を可撓性支持体の上にキレート樹脂で固定した研磨体が提案されているが、かかる研磨体は研磨性能の向上を目的とするものではないことに加えて、キレート樹脂のキレート形成機能が比較的短時間で飽和してしまう為、帯状の研磨体を送りながら用いて研磨面を連続的に入れ替えつつ研磨加工をおこなえば研磨性能の向上も期待できるが、前述のように定盤上に貼られた状態で用いられる場合には直ぐに金属イオンを捕捉する機能が低下してしまう。また、研磨粒子の目潰れおよび目零れ、あるいは研磨体の目詰まりが発生し易く、そうした場合には研磨性能が低下したり被研磨体の表面性状が悪化したりといった不具合が生じる。さらに、使用後の上記帯状の研磨体には産業廃棄物としての処理が求められる為、廃棄コストが嵩むことに加えて環境保護の観点からも問題がある。

【０００６】

また、特開２００１－１３８２１３号公報に記載された金属用研磨布およびそれを用いた研磨方法のように、キレート樹脂そのものに研磨性能を付与するように金属イオンを捕捉するものも提案されているが、かかる金属用研磨布に関してもキレート樹脂のキレート形成機能が比較的短時間で飽和してしまう為、研磨加工を所定時間継続しておこなう場合には直ぐに研磨能率が低下してしまい実用に耐えない。また、キレート配位子が主鎖に直接結合したキレート樹脂を用いている為、立体構造障害の影響を受け易く研磨液中に遊離する微細な金属粒子乃至金属イオンを捕捉し難いことに加え、主鎖が疎水性である場合にはキレート配位子の周囲に水がもたらされない為、キレート形成能力が比較的弱く、キレート樹脂そのものに十分な研磨性能を付与できない。そのような理由から、結果的にスラリを併用しなければならなかった。すなわち、前記研磨体の母材樹脂としてキレート樹脂を用いた種々の研磨体が提案されているが、スラリを用いずともＣＭＰ法による好適な研磨加工を実現する技術は未だ開発されていないのが現状である。

【０００７】

本発明は、以上の事情を背景として為されたものであり、その目的とするところは、スラリを用いずともＣＭＰ法による好適な研磨加工をおこない得る技術を提供することにある。

【０００８】

【課題を解決するための第１の手段】

かかる課題を解決する為に、本第１発明の要旨とするところは、母材樹脂および多数の研磨粒子を備えて円板状に形成され、専らＣＭＰ法による研磨加工に用いられる研磨体であって、前記母材樹脂は親水基と、アルキル鎖を介して主鎖に結合したキレート配位子とを備えたキレート樹脂であり、平均粒径が１ｎｍ以上１μｍ未満である研磨粒子を５重量％以上６０重量％未満の割合で含んでいることを特徴とするものである。

【０００９】

【第１発明の効果】

このようにすれば、前記研磨体を構成する母材樹脂はアルキル鎖を介して主鎖に結合したキレート配位子を備えたキレート樹脂である為、立体構造障害の影響を受け難く研磨液中に遊離する微細な金属粒子乃至金属イオンを捕捉し易いことに加え、親水基を備えたものである為、かかるキレート配位子の周囲に潤沢な水がもたらされることにより優れたキレート形成能力が得られる。また、平均粒径が１ｎｍ以上１μｍ未満である研磨粒子を５重

量％以上６０重量％未満の割合で含んでいる為、前記母材樹脂そのものに付与される研磨性能と相俟って十分な研磨能力が得られる。すなわち、スラリを用いずともＣＭＰ法による好適な研磨加工をおこない得る研磨体を提供することができる。なお、前記研磨粒子が５重量％以下である場合には十分な研磨能力が得られず、６０重量％以上である場合には被研磨体にスクラッチ傷が入り易くなる。

【００１０】

【第１発明の他の態様】

ここで、好適には、前記研磨体は酸化剤または還元剤を含むものである。このようにすれば、前記研磨体そのものに含まれた酸化剤または還元剤が研磨加工に際して供給される研磨液に溶け出すことにより、ＣＭＰ法における液体成分による化学的研磨に寄与するという利点がある。

【００１１】

また、好適には、前記研磨体は酸化作用あるいは還元作用を有する光触媒を１重量％以上６０重量％未満の割合で含むものである。このようにすれば、前記研磨体そのものに１重量％以上６０重量％未満の割合で含まれた光触媒が研磨加工に際して供給される研磨液に作用することにより、ＣＭＰ法において前記研磨体に光を照射することで液体成分による化学的研磨性能が向上し、研磨液として水を用いても十分な研磨性能が得られるという利点がある。なお、前記光触媒が１重量％以下である場合には酸化作用あるいは還元作用が生じ難く、６０重量％以上である場合には被研磨体にスクラッチ傷が入り易くなる。

【００１２】

【課題を解決するための第２の手段】

また、前記課題を解決するために、本第２発明の要旨とするところは、定盤上に貼られた円板状の研磨体に被研磨体を押しつけて、それらの間に研磨液を供給しつつ相対回転させる形式の研磨加工方法であって、前記研磨体として前記第１発明の研磨体を用い、常時機械的にあるいは化学的に前記母材樹脂を破壊しつつ、前記研磨体と被研磨体との間に供給されて研磨加工に用いられた研磨液を回収し且つ濾過して再び研磨液として供給することを特徴とするものである。

【００１３】

【第２発明の効果】

このようにすれば、前記研磨体として前記第１発明の研磨体を用いている為、研磨加工に際して前記母材樹脂そのものが優れた研磨能力を示すことに加え、常時機械的にあるいは化学的に前記母材樹脂を破壊しつつ研磨加工をおこなうものである為、前記研磨体に絶えず新しい研磨面が表出してその母材樹脂のキレート形成能力が低下せずに保たれる。また、前記研磨体と被研磨体との間に供給されて研磨加工に用いられた研磨液を回収し且つ濾過して再び研磨液として供給するものである為、廃棄コストが少なくて済むことに加えて環境保護の観点からも好ましい。すなわち、スラリを用いずともＣＭＰ法による好適な研磨加工をおこない得る前記研磨体を用いた好適な研磨加工方法を提供することができる。

【００１４】

【第２発明の他の態様】

ここで、好適には、前記研磨体は酸化作用あるいは還元作用を有する光触媒を１重量％以上６０重量％未満の割合で含むものであり、その研磨体に波長が２００ｎｍ以上６００ｎｍ未満である光を照射するものである。このようにすれば、前記研磨体そのものに１重量％以上６０重量％未満の割合で含まれた光触媒がＣＭＰ法による研磨加工に際して供給される研磨液に作用し、その研磨体に波長が２００ｎｍ以上６００ｎｍ未満である光を照射することで液体成分による化学的研磨性能が向上し、研磨液として水を用いても十分な研磨性能が得られるという利点がある。

【００１５】

【実施例】

以下、本発明の好適な実施例を図面に基づいて詳細に説明する。

【００１６】

図１は、本発明の一実施例である研磨体１０を示す斜視図である。この図に示すように、かかる研磨体１０は、母材樹脂１２および多数の研磨粒子１４を備えてその寸法がたとえば４５０ｍｍφ×ｔ５ｍｍ程度の円板状に形成されたものであり、後述するように、図３に示す研磨加工装置１８の研磨定盤２０に貼り付けられて、専らＣＭＰ（Ｃｈｅｍｉｃａｌ　Ｍｅｃｈａｎｉｃａｌ　Ｐｏｌｉｓｈｉｎｇ：化学的機械的研磨）法による研磨加工に用いられるものである。

【００１７】

上記母材樹脂１２としては、たとえば６重量部のビスフェノール系エポキシ主剤と、２重量部の脂環式アミン系硬化剤と、２重量部の直鎖２官能エポキシおよびイミノ２酢酸とを混合して加熱することにより得られるキレート樹脂などが好適に用いられる。図２は、かかるキレート樹脂における一部の構成を模式的に示す図であり、（ａ）は親水基がアルキル鎖の中途に設けられた構成例、（ｂ）は親水基がアルキル鎖の側鎖を成す構成例、（ｃ）は親水基がアルキル鎖の中途に設けられた構成と、アルキル鎖の側鎖を成す構成とが組み合わされた構成例である。この図に示すように、上記キレート樹脂は親水基（静電的相互作用や水素結合などによって水分子と弱い結合をつくり、水に対して親和性を示すヒドロキシル基、カルボキシル基、アミノ基、カルボニル基、スルホ基などの官能基や、エステル、アミド、エーテル、ケトン構造）１８と、アルキル鎖（一般式C_nH_{2n}で表わされる鎖状原子団）２２を介して主鎖１６に結合したキレート配位子（金属イオンなどとキレート結合を形成することができる官能基）２０とを備えたものであり、金属粒子乃至金属イオンをそのキレート配位子２０により捕捉することで、前記母材樹脂１２そのものに研磨性能が付与されるものと考えられる。ここで、好適には、上記母材樹脂１２はたとえば過酸化水素などの酸化剤または還元剤を含むものであり、さらに好適には、酸化作用あるいは還元作用を有するたとえば酸化チタンなどの光触媒を１重量％以上６０重量％未満の割合で含むものである。また、上記研磨粒子１４は、平均粒径が１ｎｍ以上１μｍ未満であるたとえば球状シリカ、アルミナ、ジルコニア、セリア、二酸化マンガンなどであり、上記研磨体１０に５重量％以上６０重量％未満の割合で含まれている。

【００１８】

前記研磨体１０は、たとえば次のようにして製造される。すなわち、先ずキレート樹脂の原料である上記所定の樹脂材料が混合および加熱されることにより、上記母材樹脂１２を構成するキレート樹脂が形成される。次にそのようにして形成されたキレート樹脂が硬化しないうちに上記酸化剤または還元剤、光触媒、および研磨粒子がそのキレート樹脂に投入されて混合および撹拌される。続いてその混合原料が所定の型に注型されて常温で硬化させられることにより、本実施例の研磨体１０が製造される。

【００１９】

図３は、前記研磨体１０が用いられるＣＭＰ法による研磨加工装置２４の大まかな構成を示す図であり、（ａ）は研磨定盤２６の軸心方向から見た平面図、（ｂ）は正面図である。この図に示すように、かかる研磨加工装置２４では、研磨定盤２６がその軸心まわりに回転可能に支持された状態で設けられており、その研磨定盤２６は、図示しない定盤駆動モータにより、図に矢印で示す１回転方向へ回転駆動されるようになっている。この研磨定盤２６の上面すなわち被研磨体が押しつけられる面には、本実施例の研磨体１０が貼り付けられている。一方、上記研磨定盤２６の近傍には、被研磨体を保持する為のワーク保持部材２８がその軸心まわりに回転可能、その軸心方向に移動可能に支持された状態で配置されており、そのワーク保持部材２８は、図示しないワーク駆動モータにより図に矢印で示す１回転方向へ回転駆動されるようになっている。かかるワーク保持部材２８の下面すなわち上記研磨体１０と対向する面には吸着層３０を介して被研磨体であるウェハ３２が吸着保持される。また、所定の弾性を備えた合成樹脂などから成る仕切板３４が、研磨体１０の中心を通り径方向に横断するように接触させられており、その仕切板３４を挟んでワーク保持部材２８側に第１ノズル３６が、反対側に第２ノズル３８がそれぞれ配置されている。また、前記研磨定盤２６の軸心に平行な軸心まわりに回転可能、その軸心方向および前記研磨定盤２６の径方向に移動可能に配置された調整工具保持部材４０と、その

調整工具保持部材４０の下面すなわち前記研磨体１０と対向する面に取り付けられた研磨体調整工具４２とが設けられている。

【００２０】

図４は、前記研磨体１０を用いてＣＭＰ法による研磨加工をおこなう工程を示す工程図である。図３および図４に示すように、ＣＭＰ法による研磨加工に際しては、先ず研磨液供給工程Ｓ１において、上記研磨定盤２６およびそれに貼り付けられた研磨体１０と、ワーク保持部材２８およびそれに吸着保持されたウェハ３２とが、上記定盤駆動モータおよびワーク駆動モータによりそれぞれの軸心まわりに回転駆動された状態で、上記第１ノズル３６および第２ノズル３８から、たとえば酢酸水溶液などの研磨液が上記研磨体１０の表面上に供給されつつ、ワーク保持部材２８に吸着保持されたウェハ３２がその研磨体１０に押しつけられる。そうすることにより、上記ウェハ３２の被研磨面すなわち上記研磨体１０に対向する面が、かかる研磨液による化学的研磨作用と、上記研磨体１０により自己供給された研磨粒子１４および金属イオンを捕捉して研磨性能が付与された母材樹脂１２による機械的研磨作用とによって平坦に研磨される。

【００２１】

上記研磨液供給工程Ｓ１と前後して、研磨体微量破壊工程Ｓ２において、前記研磨体１０が微量ずつ破壊される。かかる微量破壊は、前記調整工具保持部材４０およびそれに取り付けられた研磨体調整工具４２が、図示しない調整工具駆動モータにより回転駆動された状態で前記研磨体１０に押しつけられ、必要に応じて前記研磨定盤２６の径方向に往復移動させられることにより機械的に、および前記第２ノズル３８から供給される研磨液によって化学的に破壊するものであり、研磨加工に際して常時継続しておこなわれる。ここで、図５に示すように、前記研磨加工装置２４には前記第１ノズル３６および第２ノズル３８からそれぞれ供給される研磨液のｐＨを調整するｐＨ調整器４４が備えられており、前記第１ノズル３６からは被研磨体であるウェハ３２の研磨加工に適したたとえばｐＨ４程度の研磨液が、前記第２ノズル３８からは前記研磨体１０の母材樹脂１２を化学的に微量ずつ破壊するのに適したたとえばｐＨ１程度の研磨液がそれぞれ供給されるようになっている。かかる研磨体微量破壊工程Ｓ２により、前記研磨体１０の母材樹脂１２が微量ずつ破壊される為、絶えず新しい研磨面が表出してその母材樹脂１２のキレート形成能力が低下せずに保たれるのである。

【００２２】

また、前記研磨液供給工程Ｓ１および研磨体微量破壊工程Ｓ２と前後して、光照射工程Ｓ３において、図３（ｂ）に示すように前記研磨体１０に波長が２００ｎｍ以上６００ｎｍ未満である光が照射される。かかる研磨体１０は、前述のように、酸化作用あるいは還元作用を有するたとえば酸化チタンなどの光触媒を含むものである為、そのように照射される光は前記光触媒に酸化作用あるいは還元作用を生じさせて前記第１ノズル３０から供給される研磨液に作用し、ＣＭＰ法における液体成分による化学的研磨性能が向上する。

【００２３】

また、前記研磨液供給工程Ｓ１、研磨体微量破壊工程Ｓ２、および光照射工程Ｓ３と前後して、研磨液回収工程Ｓ４において、前記研磨体１０と被研磨体であるウェハ３２との間に供給されて研磨加工に用いられた研磨液が回収される。ここで、図５に示すように、前記研磨加工装置２４には回収された研磨液を濾過する為のたとえば孔径０．１μｍφ程度のフィルタ４６が備えられており、上記研磨液回収工程Ｓ４において回収された研磨液は、研磨液濾過工程Ｓ５において、かかるフィルタ４６により濾過されて研磨屑などの不要物が除去された後、前述のｐＨ調整器４４に送られる。そしてそのｐＨ調整器４４によりｐＨを調整されて前記第１ノズル３６および第２ノズル３８から供給されることにより、再び研磨加工に用いられるのである。

【００２４】

次に、本発明の効果を検証する為に本発明者がおこなった研磨試験について説明する。かかる研磨試験においては、６重量部のビスフェノール系エポキシ主剤と、２重量部の脂環式アミン系硬化剤と、２重量部の直鎖２官能エポキシおよびイミノ２酢酸とを混合して加

熱することにより得られるキレート樹脂を４５重量％の割合で、平均粒径が０．３μｍの球状シリカを５５重量％の割合で含む本発明の実施例試料１と、６重量部のビスフェノール系エポキシ主剤と、２重量部の脂環式アミン系硬化剤と、２重量部の直鎖２官能エポキシおよびイミノ２酢酸とを混合して加熱することにより得られるキレート樹脂を４５重量％の割合で、平均粒径が０．３μｍの球状シリカを４０重量％の割合で、平均粒径が０．３μｍの酸化チタン粉末を１５重量％の割合で含む本発明の実施例試料２と、スラリを用いた従来のＣＭＰ法に使用される発泡ウレタンパッドである比較例試料とを用意し、それぞれの試料を用いて研磨加工をおこなった。それらの試料は外径４５０ｍｍφ×厚さｔ５ｍｍ程度の寸法を備えたものであった。以下にその研磨試験の試験条件および試験結果を示す。

【００２５】

［試験条件］

ルブリカント：過酸化水素１０重量％水溶液

スラリ：８０ｎｍシリカ１２重量％含有　過酸化水素１０重量％水溶液およびｐＨ３酢酸水溶液の混合液

ワーク１：銅板（１５０ｍｍφ×ｔ１．０ｍｍ）

ワーク２：０．５μｍの溝を銅鍍金で埋めたシリコンウェハ（１５０ｍｍφ×ｔ０．６ｍｍ）

ワーク回転数：６０ｒｐｍ［１ｓ$^{-1}$］

研磨定盤回転数：６０ｒｐｍ［１ｓ$^{-1}$］

加工面圧：３００ｇｆ／ｃｍ^{2}［２９．４ｋＰａ］

研磨液量：５００ｍｌ／ｍｉｎ［８．３ｃｍ^{3}／ｓ］

その他：比較例試料２には波長３６５ｎｍの光を照射しつつ研磨加工をおこなった

[試験結果]

研磨液	研磨体	研磨能率（ワーク1）	ﾃﾞｨｯｼﾝｸﾞ量（ワーク2）
水	実施例試料１	150nm/min[2.5nm/s]	60nm
ﾙﾌﾞﾘｶﾝﾄ	実施例試料１	280nm/min[4.7nm/s]	80nm
水	実施例試料２	320nm/min[5.3nm/s]	90nm
ｽﾗﾘ	比較例試料	290nm/min[4.8nm/s]	120nm

【００２６】

かかる試験結果から、研磨液として水を用い且つ研磨体として実施例試料１を用いたもので若干研磨能率が劣る他は、本発明の実施例試料１または２を用いた研磨加工では、研磨液としてスラリを用い且つ研磨体として発泡ウレタンパッドを用いた従来のＣＭＰ法による研磨加工と同程度もしくはより優れた研磨能率を示すことが確認された。また、ワーク２のシリコンウェハに形成された０．５μｍの溝に埋められた銅鍍金の凹み量を示すディッシング量に関しては、本発明の実施例試料１または２を用いた研磨加工の何れも従来のＣＭＰ法による研磨加工より少なくて済み、より優れた表面性状が得られることが確認された。さらには、研磨体として実施例試料２を用い且つ波長３６５ｎｍの光を照射しつつ研磨加工をおこなったものでは、研磨液として水を用いても研磨能率、ディッシング量共に従来のＣＭＰ法による研磨加工より優れた結果が得られることが確認された。すなわち、本発明の研磨体およびその研磨体を用いた研磨加工方法によれば、スラリを用いずともＣＭＰ法による好適な研磨加工をおこない得ることが検証された。

【００２７】

このように、本実施例によれば、前記研磨体１０を構成する母材樹脂１２はアルキル鎖２２を介して主鎖１６に結合したキレート配位子２０を備えたキレート樹脂である為、立体構造障害の影響を受け難く研磨液中に遊離する微細な金属粒子乃至金属イオンを捕捉し易いことに加え、親水基１８を備えたものである為、かかるキレート配位子２０の周囲に潤

沢な水がもたらされることにより優れたキレート形成能力が得られる。また、平均粒径が１ｎｍ以上１μｍ未満である研磨粒子１４を５重量％以上６０重量％未満の割合で含んでいる為、前記母材樹脂１２そのものに付与される研磨性能と相俟って十分な研磨能力が得られる。すなわち、スラリを用いずともＣＭＰ法による好適な研磨加工をおこない得る研磨体１０を提供することができる。

【００２８】

また、前記研磨体１０は酸化剤または還元剤を含むものである為、前記研磨体１０そのものに含まれた酸化剤または還元剤が研磨加工に際して供給される研磨液に溶け出すことにより、ＣＭＰ法における液体成分による化学的研磨に寄与するという利点がある。

【００２９】

また、前記研磨体１０は酸化作用あるいは還元作用を有する光触媒を１重量％以上６０重量％未満の割合で含むものである為、前記研磨体１０そのものに１重量％以上６０重量％未満の割合で含まれた光触媒が研磨加工に際して供給される研磨液に作用することにより、ＣＭＰ法において前記研磨体１０に光を照射することで液体成分による化学的研磨性能が向上し、研磨液として水を用いても十分な研磨性能が得られるという利点がある。

【００３０】

また、本実施例によれば、前記研磨体１０を用いている為、研磨加工に際して前記母材樹脂１２そのものが優れた研磨能力を示すことに加え、研磨体微量破壊工程Ｓ２において常時機械的にあるいは化学的に前記母材樹脂１２を破壊しつつ研磨加工をおこなうものである為、前記研磨体１０に絶えず新しい研磨面が表出してその母材樹脂１２のキレート形成能力が低下せずに保たれる。また、研磨液供給工程Ｓ１において前記研磨体１０と被研磨体であるウェハ３２との間に供給されて研磨加工に用いられた研磨液を研磨液回収工程Ｓ４において回収し、続く研磨液濾過工程Ｓ５において濾過して、再び研磨液供給工程Ｓ１において研磨液として供給するものである為、従来のスラリを用いたＣＭＰ法による研磨加工に比べて廃棄物を１／１００～１／１０に削減することができ、廃棄コストが少なくて済むことに加えて環境保護の観点からも好ましい。すなわち、スラリを用いずともＣＭＰ法による好適な研磨加工をおこない得る前記研磨体１０を用いた好適な研磨加工方法を提供することができる。

【００３１】

また、前記研磨体１０は酸化作用あるいは還元作用を有する光触媒を１重量％以上６０重量％未満の割合で含むものであり、光照射工程Ｓ３においてその研磨体に波長が２００ｎｍ以上６００ｎｍ未満である光を照射するものである為、前記研磨体１０そのものに１重量％以上６０重量％未満の割合で含まれた光触媒がＣＭＰ法による研磨加工に際して供給される研磨液に作用し、その研磨体１０に波長が２００ｎｍ以上６００ｎｍ未満である光を照射することで液体成分による化学的研磨性能が向上し、研磨液として水を用いても十分な研磨性能が得られるという利点がある。

【００３２】

以上、本発明の好適な実施例を図面に基づいて詳細に説明したが、本発明はこれに限定されるものではなく、さらに別の態様においても実施される。

【００３３】

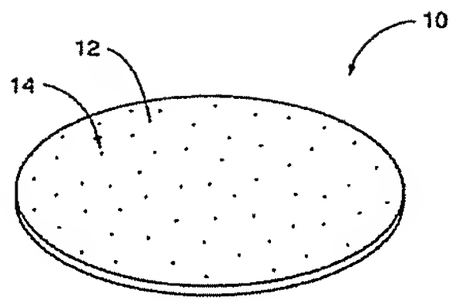
たとえば、前述の実施例では、前記研磨体１０は半導体ウェハの研磨加工に用いられていたが、本発明はこれに限定されるものではなく、たとえば金属材料の表面超仕上加工など、様々な被研磨材のＣＭＰ法による研磨加工に広く用いられるものである。

【００３４】

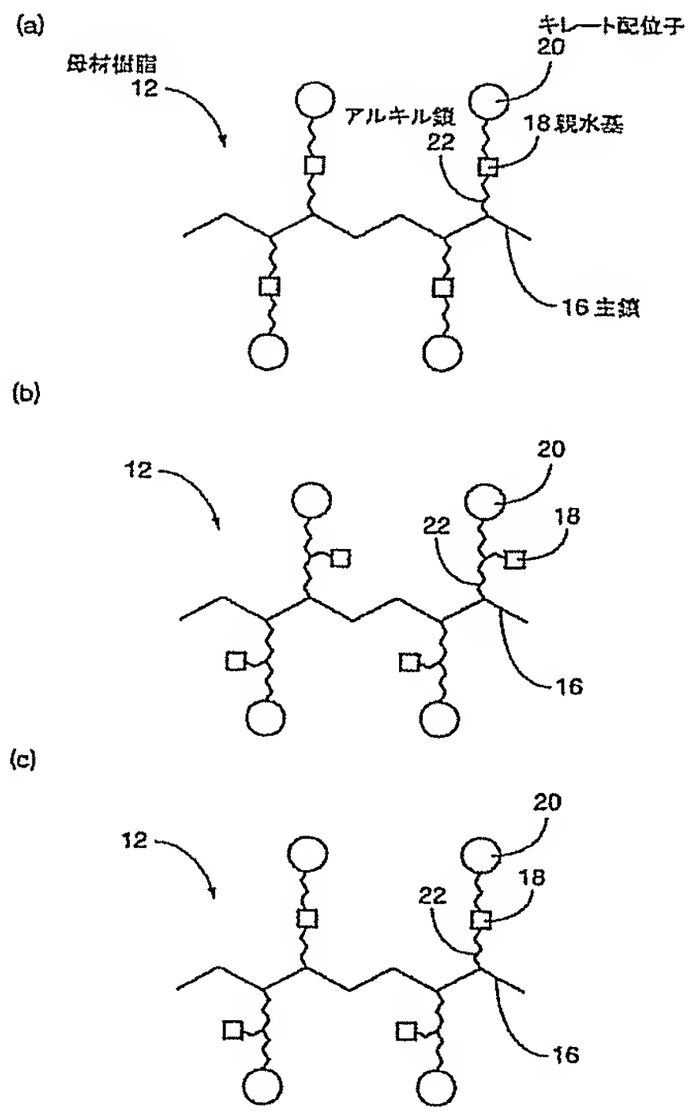
また、前述の実施例では、前記母材樹脂１２の主鎖としてエポキシ系樹脂が用いられていたが、たとえば主鎖としてアクリル系樹脂などを用いたキレート樹脂であっても構わない。前記母材樹脂１２は、ビスフェノール系エポキシ主剤と、脂環式アミン系硬化剤と、直鎖２官能エポキシおよびイミノ２酢酸とを混合して加熱することにより得られるキレート樹脂であったが、これはあくまで本発明の好適な実施例に過ぎず、たとえば被研磨体の性状などに応じて様々なキレート樹脂が適宜選択されて用いられる。

【００３５】
また、前述の実施例では、前記研磨体１０は酸化剤として過酸化水素を含むものであったが、これはたとえば硝酸鉄またはヨウ素酸カリウムなどであっても構わない。すなわち、ＣＭＰ法による研磨加工に際して研磨液に溶け出してその化学的研磨に寄与する酸化剤または還元剤であればその種類は問わない。
【００３６】
また、前述の実施例では、前記研磨体１０は光触媒として酸化チタン粉末を含むものであったが、これはたとえばシリコン半導体またはジルコニアなどであっても構わない。すなわち、酸化作用あるいは還元作用を有し、ＣＭＰ法による研磨加工に際して研磨液の化学的研磨に寄与するものであればその種類は問わない。
【００３７】
また、前述の実施例では特に説明していないが、前記母材樹脂１２の主鎖１６は前記アルキル鎖２２のみならず、たとえば親水基を備えた他のアルキル鎖など様々な側鎖を備えたものであっても当然に構わない。
【００３８】
その他一々例示はしないが、本発明はその趣旨を逸脱しない範囲内において、種々の変更が加えられて実施されるものである。
【図面の簡単な説明】
【図１】本発明の一実施例である研磨体を示す斜視図である。
【図２】図１の研磨体の母材樹脂における一部の構成を模式的に示す図であり、（ａ）は親水基がアルキル鎖の中途に設けられた構成例、（ｂ）は親水基がアルキル鎖の側鎖を成す構成例、（ｃ）は親水基がアルキル鎖の中途に設けられた構成と、アルキル鎖の側鎖を成す構成とが組み合わされた構成例である。
【図３】図１の研磨体が用いられるＣＭＰ法による研磨加工装置の大まかな構成を示す図であり、（ａ）は研磨定盤の軸心方向から見た平面図、（ｂ）は正面図である。
【図４】図１の研磨体を用いてＣＭＰ法による研磨加工をおこなう工程を示す工程図である。
【図５】図３の研磨加工装置を用いたＣＭＰ法による研磨加工における研磨液の循環を説明する図である。
【符号の説明】
１０：研磨体
１２：母材樹脂
１４：研磨粒子
１６：主鎖
１８：親水基
２０：キレート配位子
２２：アルキル鎖
２６：研磨定盤
３２：ウェハ（被研磨体）

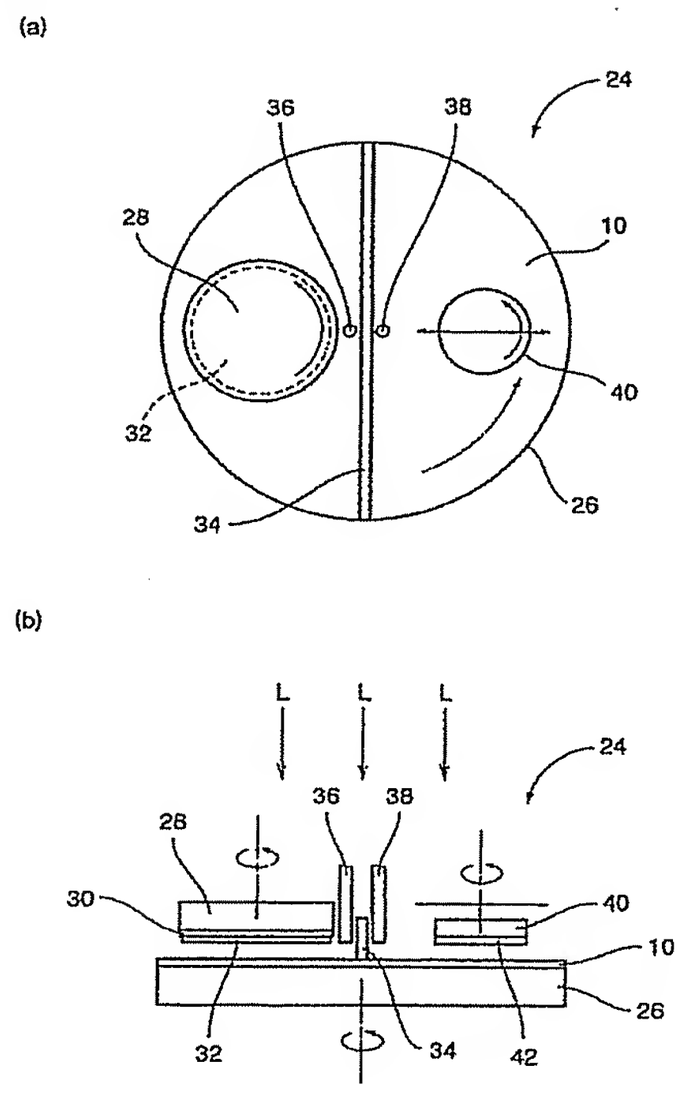
【図１】


10
12
14

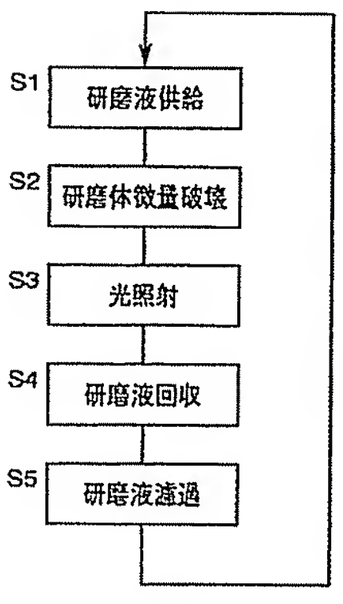
【図２】


(a)
キレート配位子
20
母材樹脂
12
アルキル鎖
18 親水基
22
16 主鎖
(b)
12
20
22
18
16
(c)
12
20
22
18
16

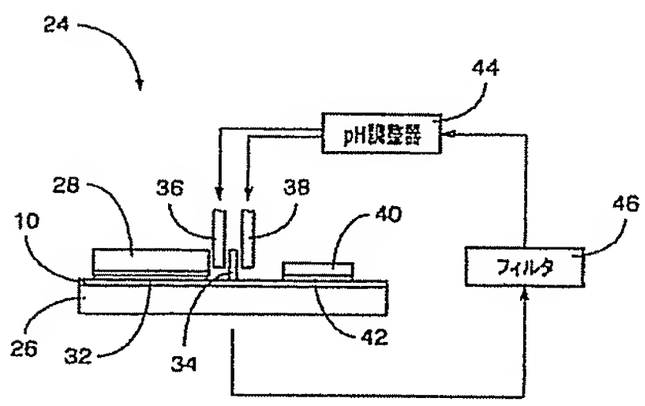
【図３】


(a)
24
36
38
28
10
40
32
34
26
(b)
L
L
L
24
36
38
28
30
40
10
26
32
34
42

【図４】


S1
研磨液供給
S2
研磨体微量破壊
S3
光照射
S4
研磨液回収
S5
研磨液濾過

【図５】


24
44
pH調整器
28
36
38
40
46
10
フィルタ
26
32
34
42